



M.M. ....

TIME .....

Name :

Father Name :

Mobile No. :

Subject : *Physics, Chemistry, Biology/Math, Mental Aptitude*

### IMPORTANT INSTRUCTIONS

1. This booklet contains 100 Questions.
2. All questions are compulsory and carry ..... mark,
3. There will be no negative marking.
4. Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
5. You will not be supplied the Answer-Sheet separately by the invigilator. You must complete the details of *Name* , *Father Name and Mobile Number* on the Answer-Sheet carefully, as per detailed instructions supplied by Academy, before you actually start answering the questions, failing which your Answer-Sheet will not be evaluated and you will be awarded 'ZERO' mark.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone, any electronic device, etc., except the I - Card, inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only. Use of white fluid for correction is not permissible on the Answer Sheet. No rough work is to be done on the Answer-Sheet.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/ Hall; however, the candidates are allowed to take away this Test Booklet with them.



# VIGYAN DHARA

IIT-JEE/NEET/AIIMS

*The Temple of Education*



## PHYSICS

- 1 Four charges  $q$ ,  $2q$ ,  $-4q$  and  $2q$  are placed in order at the four corners of a square of side  $b$ . The net field at the centre of the square is –

(A)  $\frac{q}{2\pi\epsilon_0 b^2}$  from  $+q$  to  $-4q$

(B)  $\frac{5q}{2\pi\epsilon_0 b^2}$  from  $+q$  to  $-4q$

(C)  $\frac{10q}{2\pi\epsilon_0 b^2}$  from  $+q$  to  $-4q$

(D)  $\frac{20q}{2\pi\epsilon_0 b^2}$  from  $-4q$  to  $+q$

- 2 A half ring of radius  $R$  has a charge of  $\lambda$  per unit length. The potential at the centre of the half ring is –

(A)  $k \frac{\lambda}{R}$

(B)  $k \frac{\lambda}{\pi R}$

(C)  $k \frac{\lambda}{R}$

(D)  $k\pi\lambda$

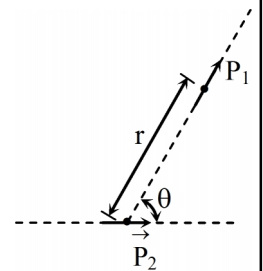
- 3 Two short electric dipoles are placed as shown. The energy of electric interaction between these dipoles will be –

(A)  $\frac{2kP_1P_2 \cos \theta}{r^3}$

(B)  $\frac{-2kP_1P_2 \cos \theta}{r^3}$

(C)  $\frac{-2kP_1P_2 \sin \theta}{r^3}$

(D)  $\frac{-4kP_1P_2 \cos \theta}{r^3}$



- 4 Electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10 cm surrounding the total charge is 25 V-m. The flux over a concentric sphere of radius 20 cm will be –

(A) 25 V-m

(B) 50 V-m

(C) 100 V-m

(D) 200 V-m

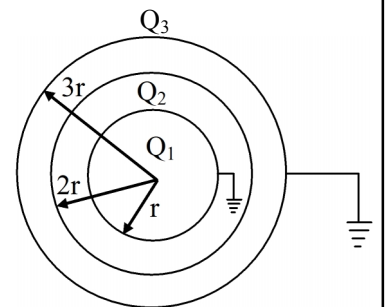
- 5 Three concentric conducting spherical shells have radius  $r$ ,  $2r$  and  $3r$  and  $Q_1$ ,  $Q_2$  and  $Q_3$  are final charges respectively. Innermost and outermost shells are already earthed as shown in figure. Choose the wrong statement.

(A)  $Q_1 + Q_3 = -Q_2$

(B)  $Q_1 = \frac{-Q_2}{4}$

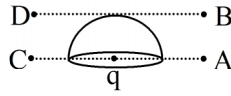
(C)  $\frac{Q_3}{Q_1} = 3$

(D)  $\frac{Q_3}{Q_2} = \frac{-1}{3}$



Space for Rough Work

- 6 Figure shows a charge  $q$  placed at the centre of a hemisphere. Another charge  $Q$  can be put on the positions A, B, C and D. In which position(s) of this another charge, the flux of the electric field through the hemisphere remains unchanged -



- (A) A, C (B) B, D (C) C, D (D) A, D

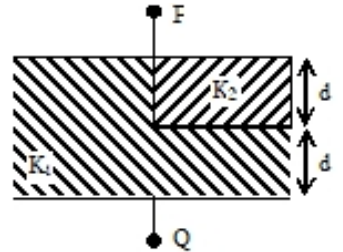
- 7 What is the capacitance of the capacitor of square plates of area  $A$ , Shown in figure -

(A)  $\frac{\epsilon_0 A}{4d} \frac{K_1 K_2}{K_1 + K_2}$

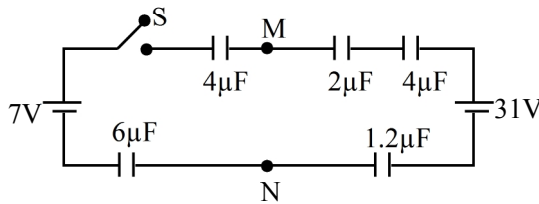
(B)  $\frac{\epsilon_0 A}{d} \frac{K_1(K_1 + K_2)}{3K_1 + K_2}$

(C)  $\frac{\epsilon_0 A}{4d} \frac{K_1(K_1 + 3K_2)}{K_1 + K_2}$

(D)  $\frac{\epsilon_0 A}{4d(K_1 + 3K_2)}$

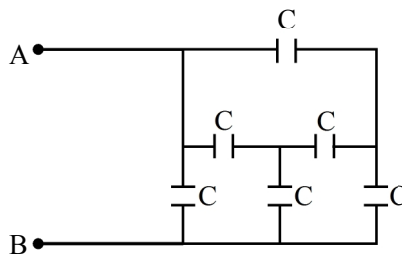


- 8 Five capacitors are connected as shown in figure below. Initially  $S$  is opened and all capacitors are uncharged. When  $S$  is closed, steady state is obtained. The p.d. between the points  $M$  and  $N$  will be .....



- (A) 6 V (B) 8V (C) 12V (D) 4V

- 9 The equivalent capacitance between point A and B is -

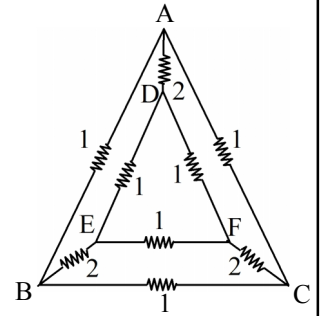


- (A)  $C/4$  (B)  $C/2$  (C)  $C$  (D)  $2C$

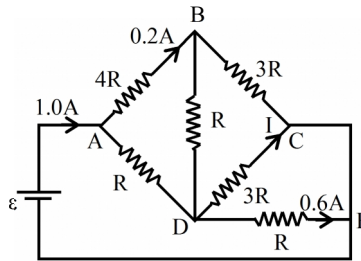
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- 10 A network of nine conductors connects six points A, B, C, D, E and F as shown below. The digits denote resistances in  $\Omega$ . Find the equivalent resistance between B and C -

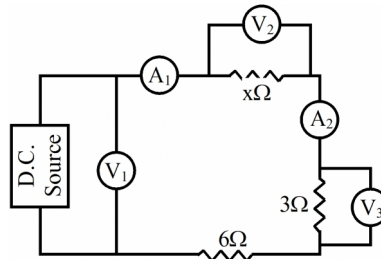
- (A)  $\frac{2}{15} \Omega$  (B)  $\frac{7}{12} \Omega$   
 (C)  $\frac{5}{12} \Omega$  (D)  $\frac{11}{12} \Omega$



- 11 The current I in the circuit shown in the figure is -



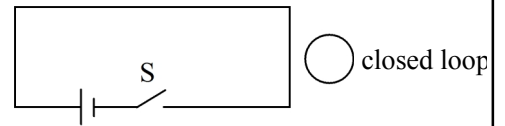
- (A) 0 (B) 0.1 A (C) 0.4 A (D) 0.2 A
- 12 In the electric circuit shown in figure, the reading of voltmeter  $V_1$  is 26 volt, and the reading of ammeter  $A_1$  is 2 ampere. The value of resistance x is - (all instruments are ideal)



- (A)  $2 \Omega$  (B)  $4 \Omega$  (C)  $6 \Omega$  (D)  $8 \Omega$
- 13 A uniform magnetic field exists in region given by  $\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ . A rod of length 5 m is placed along y-axis is moved along x-axis with constant speed 1 m/sec. Then induced e.m.f. in the rod will be-
- (A) zero (B) 25 volt (C) 20 volt (D) 15 volt

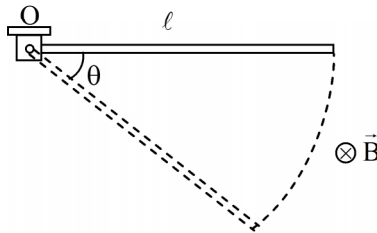
Space for Rough Work

- 14 Consider the situation shown in figure. If the switch is closed and after some time it is opened again, the closed loop will show-



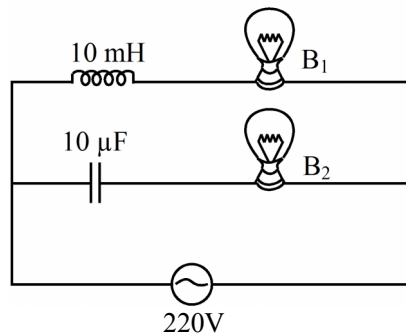
- (A) an anticlockwise current-pulse  
 (B) a clockwise current-pulse  
 (C) an anticlockwise current-pulse and then a clockwise current-pulse  
 (D) a clockwise current-pulse and then an anticlockwise current-pulse

- 15 A conducting rod of length  $\ell$  is hinged at point O. It is free to rotate in a vertical plane. The rod is released from the position shown. The potential difference between the two ends of the rod is proportional to-



- (A)  $\ell^2$                                       (B)  $\ell$                                       (C)  $\sin \theta$                                       (D)  $(\sin \theta)^{1/2}$
- 16 RMS value of ac  $i = i_1 \cos \omega t + i_2 \sin \omega t$  will be-
- (A)  $\frac{1}{\sqrt{2}} (i_1 + i_2)$                                       (B)  $\frac{1}{\sqrt{2}} (i_1 + i_2)^2$                                       (C)  $\frac{1}{\sqrt{2}} (i_1^2 + i_2^2)^{1/2}$                                       (D)  $\frac{1}{2} (i_1^2 + i_2^2)^{1/2}$

- 17 Two identical bulbs  $B_1$  and  $B_2$  are connected to an ac source.  $B_1$  is connected in series with a coil of 100 mH and  $B_2$  with a capacitor of 10  $\mu\text{F}$  as shown in the figure. The brightness of  $B_1$  and  $B_2$  will be-

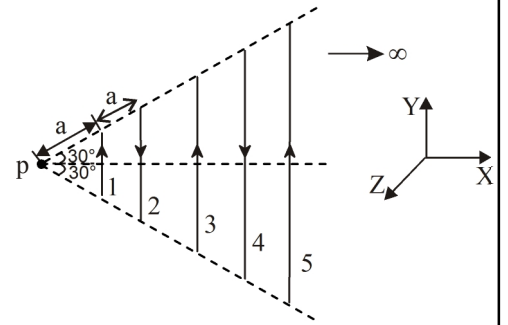


- (A) Same in both                                      (B) More in  $B_1$   
 (C) Depending on the frequency of the source                                      (D) More in  $B_2$

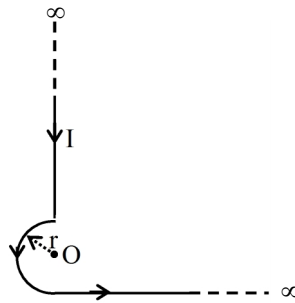
Space for Rough Work

18 Infinite number of straight wires each carrying current  $I$  are equally placed as shown in the figure. Adjacent wires have current in opposite direction. Net magnetic field at point P is-

- (A)  $\frac{\mu_0 I}{4\pi} \frac{\ln 2}{\sqrt{3}a} \hat{k}$                       (B)  $\frac{\mu_0 I}{4\pi} \frac{\ln 4}{\sqrt{3}a} \hat{k}$   
 (C)  $\frac{\mu_0 I}{4\pi} \frac{\ln 4}{\sqrt{3}a} (-\hat{k})$                       (D) zero



19 In the figure, the magnetic induction at point O is –



- (A)  $\frac{\mu_0 I}{4\pi r}$                       (B)  $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{2\pi r}$                       (C)  $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{4\pi r}$                       (D)  $\frac{\mu_0 I}{4r} - \frac{\mu_0 I}{4\pi r}$

20 A charge  $q$  is moving with a velocity  $\vec{v}_1 = 1 \hat{i}$  m/s at a point in a magnetic field and experiences a force  $\vec{F}_1 = q(-1 \hat{j} + 1 \hat{k})$  N. If the charge is moving with a velocity  $\vec{v}_2 = 1 \hat{j}$  m/s at the same point, it experiences and a force  $\vec{F}_2 = q[1 \hat{i} - 1 \hat{k}]$  N. The magnetic induction  $\vec{B}$  at that point is-

- (A)  $(\hat{i} + \hat{j} + \hat{k})$  Wb/m<sup>2</sup>                      (B)  $(\hat{i} - \hat{j} + \hat{k})$  Wb/m<sup>2</sup>  
 (C)  $(-\hat{i} + \hat{j} - \hat{k})$  Wb/m<sup>2</sup>                      (D)  $(\hat{i} + \hat{j} - \hat{k})$  Wb/m<sup>2</sup>

Space for Rough Work

## CHEMISTRY

21. Consider a Body Centered Cubic (bcc) arrangement, let  $d_e$ ,  $d_{fd}$ ,  $d_{bd}$  be the distances between successive atoms located along the edge, the face-diagonal, the body diagonal respectively in a unit cell. Their order is given by:  
 (A)  $d_e < d_{fd} < d_{bd}$                       (B)  $d_{fd} > d_{bd} > d_e$                       (C)  $d_{fd} > d_e > d_{bd}$                       (D)  $d_{bd} > d_e > d_{fd}$
22. The shortest distance between I<sup>st</sup> and V<sup>th</sup> layer of HCP arrangement is :  
 (A)  $8\sqrt{\frac{2}{3}} r$                       (B)  $4\sqrt{\frac{3}{2}} r$                       (C)  $16\frac{\sqrt{2}}{3} r$                       (D)  $8\sqrt{\frac{3}{2}} r$
23. The maximum percentage of available volume that can be filled in a face centred cubic system by atoms is -  
 (A) 74%                      (B) 68%                      (C) 34%                      (D) 26%
24. The spinel structure ( $AB_2O_4$ ) consists of an fcc array of  $O^{2-}$  ions in which the :  
 (A) A cation occupies one-eighth of the tetrahedral holes and B cation occupies one-half of octahedral holes  
 (B) A cation occupies one-fourth of the tetrahedral holes and the B cations the octahedral holes  
 (C) A cation occupies one-eighth of the octahedral hole and the B cation the tetrahedral holes  
 (D) A cation occupies one-fourth of the octahedral holes and the B cations the tetrahedral holes
25. The vapour pressure of the solution of two liquids A ( $p^\circ = 80$  mm) and B ( $p^\circ = 120$  mm) is found to be 100 mm when  $x_A = 0.4$ . The result shows that  
 (A) solution exhibits ideal behaviour  
 (B) solution shows positive deviations  
 (C) solution shows negative deviations  
 (D) solution will show positive deviations for lower concentration and negative deviations for higher concentrations.
26. If  $M_{\text{normal}}$  is the normal molecular mass and  $\alpha$  is the degree of ionization of  $K_3[Fe(CN)_6]$ , then the abnormal molecular mass of the complex in the solution will be :  
 (A)  $M_{\text{normal}} (1 + 2\alpha)^{-1}$                       (B)  $M_{\text{normal}} (1 + 3\alpha)^{-1}$                       (C)  $M_{\text{normal}} (1 + \alpha)^{-1}$                       (D) equal to  $M_{\text{normal}}$
27.  $PtCl_4 \cdot 6H_2O$  can exist as a hydrated complex 1 molal aq. solution has depression in freezing point of  $3.72^\circ$ . Assume 100% ionisation and  $K_f(H_2O) = 1.86^\circ \text{ mol}^{-1} \text{ kg}$ , then complex is -  
 (A)  $[Pt(H_2O)_6]Cl_4$                       (B)  $[Pt(H_2O)_4Cl_2]Cl_2 \cdot 2H_2O$   
 (C)  $[Pt(H_2O)_3Cl_3]Cl \cdot 3H_2O$                       (D)  $[Pt(H_2O)_2Cl_4] \cdot 4H_2O$

Space for Rough Work



28. Osmotic pressure of 30% solution of glucose is 1.20 atm and that of 3.42% solution of cane sugar is 2.5 atm. The osmotic pressure of the mixture containing equal volumes of the two solutions will be  
 (A) 2.5 atm (B) 3.7 atm (C) 1.85 atm (D) 1.3 atm.

29. In the following reaction :  $x\text{A} \longrightarrow y\text{B}$

$$\log \left[ -\frac{d[\text{A}]}{dt} \right] = \log \left[ \frac{d[\text{B}]}{dt} \right] + 0.3$$

where -ve sign indicates rate of disappearance of the reactant. Thus, x : y is :

- (A) 1 : 2 (B) 2 : 1 (C) 3 : 1 (D) 3 : 10
30. For a reaction  $2\text{A} + \text{B} \rightarrow \text{product}$ , rate law is  $-\frac{d[\text{A}]}{dt} = k[\text{A}]$ . At a time when  $t = \frac{1}{k}$ , concentration of the reactant is : ( $C_0$  = initial concentration)  
 (A)  $\frac{C_0}{e}$  (B)  $C_0 e$  (C)  $\frac{C_0}{e^2}$  (D)  $\frac{1}{C_0}$

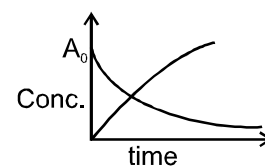
31. Which is not true for a second order reaction ?

- (A) It can have rate constant  $1 \times 10^{-2} \text{ L mol}^{-1} \text{ s}^{-1}$   
 (B) Its half-life is inversely proportional to its initial concentration  
 (C) Time to complete 75% reaction is twice of half-life

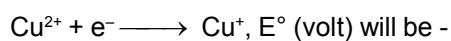
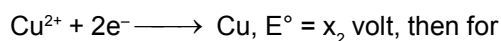
(D)  $T_{50} = \frac{1}{K \times \text{Initial conc.}}$

32. At the point of intersection of the two curves shown, the conc. of B is given by.....for,  $\text{A} \rightarrow n\text{B}$  :

- (A)  $\frac{nA_0}{2}$  (B)  $\frac{A_0}{n-1}$   
 (C)  $\frac{nA_0}{n+1}$  (D)  $\left( \frac{n-1}{n+1} \right) A_0$



33.  $\text{Cu}^+ + e^- \longrightarrow \text{Cu}$ ,  $E^\circ = x_1$  volt ;



- (A)  $x_1 - 2x_2$  (B)  $x_1 + 2x_2$  (C)  $x_1 - x_2$  (D)  $2x_2 - x_1$

Space for Rough Work

34.  $\text{Pt} \left| \text{H}_2 \right|_{(p_1)} \left| \text{H}^+ \right|_{(1\text{M})} \parallel \left| \text{H}^+ \right|_{(1\text{M})} \left| \text{H}_2 \right|_{(p_2)} \left| \text{Pt} \right.$  (where  $p_1$  and  $p_2$  are pressures) cell reaction will be spontaneous if :
- (A)  $p_1 = p_2$                       (B)  $p_1 > p_2$                       (C)  $p_2 > p_1$                       (D)  $p_1 = 1 \text{ atm}$
35.  $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \longrightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$ , If  $\text{H}^+$  concentration is decreased from 1 M to  $10^{-4}$  M at  $25^\circ\text{C}$ , where as concentration of  $\text{Mn}^{2+}$  and  $\text{MnO}_4^-$  remain 1 M.
- (A) the potential decreases by 0.38 V with decrease in oxidising power  
 (B) the potential increases by 0.38 V with increase in oxidising power  
 (C) the potential decreases by 0.25 V with decrease in oxidising power  
 (D) the potential decreases by 0.38 V without affecting oxidising power
36. If 0.224 L of  $\text{H}_2$  gas is formed at the cathode, the volume of  $\text{O}_2$  gas formed at the anode under identical conditions, is
- (A) 0.224 L                      (B) 0.448 L                      (C) 0.112 L                      (D) 1.12 L
37. Finely divided catalyst has greater surface area and has greater catalytic activity than the compact solid. If a total surface area of  $6291456 \text{ cm}^2$  is required for adsorption in a catalysed gaseous reaction, then how many splits should be made to a cube of exactly 1 cm in length to achieve required surface area. (Given : One split of a cube gives eight cubes of same size)
- (A) 60                      (B) 80                      (C) 20                      (D) 22
38. Which one is false in the following statement ?
- (A) A catalyst is specific in its action  
 (B) A very small amount of the catalyst alters the rate of a reaction  
 (C) The number of free vacancies on the surface of the catalyst increases on sub-division  
 (D) Ni is used as a catalyst in the manufacture of ammonia
39. For the coagulation of 200 mL of  $\text{As}_2\text{S}_3$  solution, 10 mL of 1 M NaCl is required. What is the coagulating value (number of milli moles of solute needed for coagulation of 1 liter of solution) of NaCl.
- (A) 200                      (B) 100                      (C) 50                      (D) 25
40. Peptisation is :
- (A) conversion of a colloidal into precipitate form  
 (B) conversion of precipitate into colloidal sol  
 (C) conversion of metal into colloidal sol by passage of electric current  
 (D) conversion of colloidal sol into macromolecules

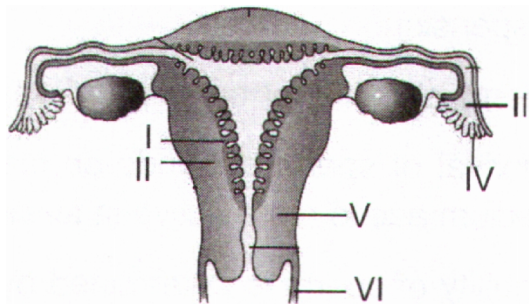
Space for Rough Work

**BIOLOGY**

41. The coconut water from tender coconut represents  
(A) Free nuclear endosperm (B) Endocarp  
(C) Fleshy mesocarp (D) Free nuclear proembryo
42. Seed formation without fertilization in flowering plants involves the process of  
(A) Apomixis (B) Sporulation (C) Budding (D) Somatic hybridization
43. Filiform apparatus is a characteristic feature of:  
(A) Zygote (B) Suspensor (C) Egg (D) Synergid
44. A human female with Turner's syndrome:  
(A) Has 45 chromosomes with XO  
(B) Has one additional X chromosome  
(C) Exhibits male characters  
(D) Is able to produce children with normal husband
45. ABO blood grouping is controlled by gene I which has three alleles and show co-dominance. There are six genotypes. How many phenotypes in all are possible?  
(A) Six (B) Three (C) Four (D) Five
46. If a colourblind woman marries a normal visioned man, their sons will be  
(A) All normal visioned  
(B) One-half colourblind and one-half normal  
(C) Three-fourths colourblind and one-fourth normal  
(D) All colourblind
47. Synthesis of leading and lagging strand require  
(A) Single primer  
(B) Single and many primers respectively  
(C) Many and single primers respectively  
(D) Many primers
48. Identification and binding of RNA polymerase to the promoter sequence is a function of  
(A) Rho factor (B) Sigma factor (C) Beta factor (D) Omega factor

**Space for Rough Work**

49. Removal of RNA polymerase III from nucleoplasm will affect the synthesis of  
 (A) mRNA (B) rRNA (C) tRNA (D) hnRNA
50. Removal of introns and joining of exons in a defined order during transcription is called  
 (A) Slicing (B) Splicing (C) Looping (D) Inducing
51. Which of the following depicts the correct pathway of transport of sperms?  
 (A) Rete testis → Vasa efferentia → Epididymis → Vas deferens  
 (B) Rete testis → Epididymis → Vasa efferentia → Vas deferens  
 (C) Rete testis → Vas deferens → Vasa efferentia → Epididymis  
 (D) Vasa efferentia → Rete testis → Vas deferens → Epididymis
52. The mammary glands are paired structures that contain the glandular tissue and variable amount of fat. The correct sequence of tissues involved in synthesis and flow of milk are  
 (A) Mammary lobes → Mammary alveoli → Mammary ampulla → Mammary duct → Lactiferous duct  
 (B) Mammary lobes → Mammary alveoli → Mammary duct → Mammary ampulla → Lactiferous duct  
 (C) Mammary lobes → Mammary alveoli → Lactiferous duct → Mammary ampulla → Mammary duct  
 (D) Mammary alveoli → Mammary lobes → Lactiferous duct → Mammary duct
53. The figure given below depicts a diagrammatic sectional view of the female reproductive system of humans. Which one set of three parts out of I — VI have been correctly identified?



- (A) (I) Perimetrium, (II) Myometrium, (III) Fallopian tube  
 (B) (II) Endometrium, (III) Infundibulum, (IV) Fimbriae  
 (C) (III) Infundibulum, (IV) Fimbriae, (V) Cervix  
 (D) (IV) Oviducal funnel, (V) Uterus, (VI) Cervix

Space for Rough Work

54. In the fertile human female, approximately on which day of the menstrual cycle does ovulation take place?  
(A) Day 14                      (B) Day 18                      (C) Day 1                      (D) Day 8
55. Which of the following can be included under natural methods of birth control?  
(A) Rhythm method                      (B) Coitus interruptus  
(C) Lactational amenorrhoea                      (D) All of these
56. AIDS is caused by Human Immunodeficiency Virus (HIV). HIV can get transmitted through  
(A) Blood contact                      (B) Sexual contact  
(C) Handshake                      (D) Both (A) and (B)
57. MTPs are considered relatively safe up to \_\_\_\_\_ weeks of pregnancy  
(A) 12                      (B) 20                      (C) 25                      (D) 18
58. The two key concepts of Darwinian theory of evolution are  
(A) Fitness                      (B) Branching descent  
(C) Natural selection                      (D) Both (B) and (C)
59. The dinosaurs descended from \_\_\_\_\_ ancestors, which are extinct  
(A) Therapsids                      (B) Pelycosaur                      (C) Synapsids                      (D) Thecodonts
60. The chronological order of human evolution from early to the recent is  
(A) Australopithecus → Ramapithecus → Homo habilis → Homo erectus  
(B) Ramapithecus → Australopithecus → Homo habilis → Homo erectus  
(C) Ramapithecus → Homo habilis → Australopithecus → Homo erectus  
(D) Australopithecus → Homo habilis → Ramapithecus → Homo erectus

Space for Rough Work

## MATHEMATICS

61. The number of solution(s) of the equation,  $\sin^{-1}x + \cos^{-1}(1-x) = \sin^{-1}(-x)$ , is/are  
 (A) 0 (B) 1 (C) 2 (D) more than 2
62. If  $a = \frac{1}{4} + i\frac{\sqrt{3}}{4}$  and  $z = x + iy$ , then  $\sin^{-1}|z|^2 + \cos^{-1}(a\bar{z} + \bar{a}z - 2)$  equals to :  
 (A) 0 (B)  $\frac{\pi}{4}$  (C)  $\frac{\pi}{2}$  (D)  $\frac{3\pi}{2}$
63. Let  $f(x) = \begin{cases} (-1)^{[x^2]} & \text{if } x < 0 \\ \lim_{n \rightarrow \infty} \frac{1}{1+x^n} & \text{if } x \geq 0 \end{cases}$ . Then  $\lim_{x \rightarrow 0} f(x)$  equals (where  $[.]$  represents greatest integer function)  
 (A) -1 (B) 1 (C) 0 (D) does not exist
64. If  $f(x) = [x^2] + \sqrt{\{x\}^2}$ , where  $[.]$  and  $\{.\}$  denote the greatest integer and fractional part functions respectively, then-  
 (A)  $f(x)$  is continuous at all integral points except 0  
 (B)  $f(x)$  is continuous and differentiable at  $x = 0$   
 (C)  $f(x)$  is discontinuous for all  $x \in I - \{1\}$   
 (D)  $f(x)$  is not differentiable for all  $x \in I$ .
65. If  $f(x) = \lim_{n \rightarrow \infty} \frac{\{e^x\}^n - 1}{\{e^x\}^n + 1}$ , where  $\{.\}$  represents fractional part function, then -  
 (A)  $f(x)$  is a discontinuous function  
 (B)  $f(x)$  is an even function  
 (C)  $f(x)$  is continuous but non-differentiable function  
 (D)  $f(x)$  is not defined for all real numbers.
66. The value of  $f(0)$ , so that the function  $f(x) = \frac{\sqrt{a^2 - ax + x^2} - \sqrt{a^2 + ax + x^2}}{\sqrt{a+x} - \sqrt{a-x}}$  ( $a > 0$ ) becomes continuous for all  $x$ , is given by -  
 (A)  $a\sqrt{a}$  (B)  $\sqrt{a}$  (C)  $-\sqrt{a}$  (D)  $-a\sqrt{a}$

**Space for Rough Work**

67. The value of  $\lim_{x \rightarrow \frac{1}{2}} \frac{\cos^{-1}(3x - 4x^3)}{x - \frac{1}{2}}$  equals
- (A) 2 (B)  $2\sqrt{3}$  (C)  $-2\sqrt{3}$  (D) does not exist
68. If  $y = \frac{1}{t^2 + t - 2}$  where  $t = \frac{1}{x-1}$ , then the number of points of discontinuities of  $y = f(x)$ ,  $x \in \mathbb{R}$  is
- (A) 1 (B) 2 (C) 3 (D) infinite
69. If  $f(x)$  is differentiable everywhere, then:
- (A)  $|f|$  is differentiable everywhere (B)  $|f|^2$  is differentiable everywhere  
 (C)  $f|f|$  is not differentiable at some point (D)  $f + |f|$  is differentiable everywhere
70. Let  $f(x) = x - x^2$  and  $g(x) = \begin{cases} \max f(t), & 0 \leq t \leq x, 0 \leq x \leq 1 \\ \sin \pi x, & x > 1 \end{cases}$ , then in the interval  $[0, \infty)$
- (A)  $g(x)$  is everywhere continuous except at two points  
 (B)  $g(x)$  is everywhere differentiable except at two points  
 (C)  $g(x)$  is everywhere differentiable except at  $x = 1$   
 (D) none of these
71. The curve  $y - e^{xy} + x = 0$  has a vertical tangent at
- (A) (1, 1) (B) (0, 1) (C) (1, 0) (D) no point
72. The coordinates of the point of the parabola  $y^2 = 8x$ , which is at minimum distance from the circle  $x^2 + (y + 6)^2 = 1$  are
- (A) (2, -4) (B) (18, -12) (C) (2, 4) (D) none of these
73. Let  $f(x) = (1 + b^2)x^2 + 2bx + 1$  and let  $m(b)$  be the minimum value of  $f(x)$ . As  $b$  varies, the range of  $m(b)$  is
- (A)  $[0, 1]$  (B)  $\left(0, \frac{1}{2}\right]$  (C)  $\left[\frac{1}{2}, 1\right]$  (D) (0, 1]
74. The function  $f(x) = x^3 - 6x^2 + ax + b$  satisfy the conditions of Rolle's theorem on  $[1, 3]$ . Which of these are correct ?
- (A)  $a = 11, b \in \mathbb{R}$  (B)  $a = 11, b = -6$  (C)  $a = -11, b = 6$  (D)  $a = -11, b \in \mathbb{R}$

Space for Rough Work

75. If  $x = at^2$ ,  $y = 2at$ , then  $\frac{d^2y}{dx^2}$  is equal to  
 (A)  $-\frac{1}{t^2}$  (B)  $\frac{1}{2at^2}$  (C)  $-\frac{1}{t^3}$  (D)  $-\frac{1}{2at^3}$
76. How many matrices can be obtained by using one or more numbers from four given numbers-  
 (A) 76 (B) 148 (C) 124 (D) None
77. If A and B are square matrices of same order and  $AA^T = I$  then  $(A^TBA)^{10}$  is equal to -  
 (A)  $AB^{10}A^T$  (B)  $A^TB^{10}A$  (C)  $A^{10}B^{10}(A^T)^{10}$  (D)  $10A^TBA$
78. If  $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$  then let us define a function  $f(x) = \det(A^T A^{-1})$  then which of the following is not correct value of  $\underbrace{f(f(f(\dots f(x))))}_{n \text{ times}}$  ( $n \geq 2$ )  
 (A)  $f^n(x)$  (B) 1 (C)  $f^{n-1}(x)$  (D)  $nf(x)$
79. If  $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ ,  $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$  and  $Q = PAP^T$  and  $x = P^T Q^{2005} P$ , then x is equal to -  
 (A)  $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$  (B)  $\begin{bmatrix} 4 + 2005\sqrt{3} & 6015 \\ 2005 & 4 - 2005\sqrt{3} \end{bmatrix}$   
 (C)  $\frac{1}{4} \begin{bmatrix} 2 + \sqrt{3} & 1 \\ -1 & 2 - \sqrt{3} \end{bmatrix}$  (D)  $\frac{1}{4} \begin{bmatrix} 2005 & 2 - \sqrt{3} \\ 2 + \sqrt{3} & 2005 \end{bmatrix}$
80. Given the relation  $R = \{(2, 3), (3, 4)\}$  on the set  $\{2, 3, 4\}$ . The minimum number of ordered pairs to be added to R so that R is reflexive and symmetric -  
 (A) 4 (B) 5 (C) 7 (D) 6

Space for Rough Work



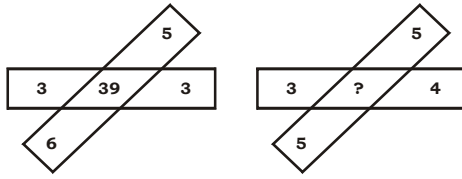
**MENTAL APTITUDE**

81. In a certain code, BONUS is written as CNOTT. How is COAST written in that code language?  
(A) DBOEJE (B) DNBRU  
(C) BPBTS (D) BBMEHE
82. If 'black' is called 'red', 'red' is called 'white', 'white' is called 'brown', 'brown' is called 'yellow', 'yellow' is called 'blue' and 'blue' is called 'green', then what is the colour of carrot ?  
(A) blue (B) green  
(C) white (D) None of these
83. Nitin ranks eighteenth in a class of 36 students. What is his rank from the last?  
(A) 18 (B) 19 (C) 31 (D) 32
84. In a group of six children T, K, V, O, M and W, T is fatter than M but not as fat as W. K is not the fattest nor is W whereas V is the thinnest. Who is the fattest among them all?  
(A) O (B) T  
(C) M (D) Data inadequate
85. Vishal walks 2 km towards North. He then turns right and walks 3 km. He now turns left and walks 5 km. Further, he moves 2 km after turning to the left. In which direction is he facing?  
(A) West (B) East (C) North (D) South
86. Pointing to a woman in the photograph a man said, "She is the wife of my grandmother's only son. How is the woman related to the man?  
(A) Mother (B) Daughter  
(C) Sister-in-law (D) Sister
87. How many pairs of letters are there in the word INCHARGE which have the same number of letters between them as in English alphabet?  
(A) Three (B) Four (C) Five (D) Six
88. Abha correctly remembers that her mother's birthday is before thursday but after sunday. Her brother Abhay correctly remembers that their mother's birthday is after tuesday while before friday. On which of the following days does their mother's birthday definitely fall?  
(A) Tuesday (B) Wednesday  
(C) Thursday (D) Friday

**Space for Rough Work**

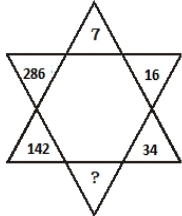
**Directions :** Find out missing number/letter/number and letter from the following given options/figures.

89.



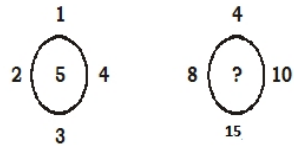
- (A) 47 (B) 45 (C) 37 (D) 35

90.



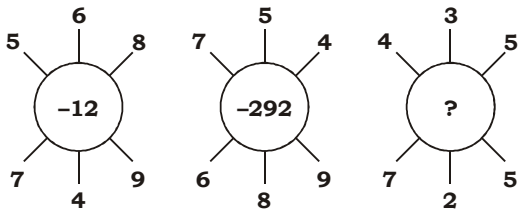
- (A) 70 (B) 84 (C) 68 (D) 66

91.



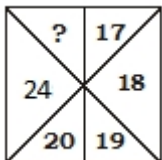
- (A) 20 (B) 40 (C) 60 (D) 80

92.



- (A) -15 (B) -10 (C) -35 (D) -40

93.



- (A) 19 (B) 22 (C) 26 (D) 28

Space for Rough Work

**Directions (94-95) :** In each of the following questions, select the related letter/word/number from the given alternatives.

94. Radio : Marconi : : Aeroplane : ?

- (A) Picture tube (B) Right Brothers  
(C) Receiver (D) JL Baird

95. Perpetual : Irregular : : Prevent : ?

- (A) Check (B) Appeal (C) Stop (D) Allow

96. If  $\div$  means  $-$ ,  $-$  means  $\times$ ,  $\times$  means  $+$  and  $+$  means  $\div$ , then  $32 \div 8 - 4 \times 12 + 4 = ?$

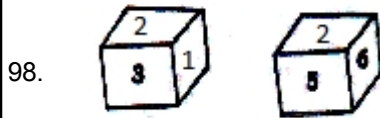
- (A) 12 (B) 3 (C) 40 (D) -14

97. From the given alternative, select the one word which can not be formed using the letters of the given word.

PRAGMATIC

- (A) GITAR (B) AGMAR (C) GAME (D) MAGIC

**Directions :** Find out the correct alternative of the question 98 based on the Dice figures.



The number opposite side the face having the no. 4 will be-

- (A) 1 (B) 2 (C) 5 (D) 6

**Directions:** In question no. 99 four figures are given. One of these figures does not fit with the rest of the figures. Find out that correct serial number.



- (A) A (B) B (C) C (D) D

100. Six persons A, B, C, D, E and F are standing in a circle. B is between F and C, A is between E and D, F is to the left of D Who is between A and C?

- (A) B (B) C (C) D (D) E

Space for Rough Work

**ANSWER KEY (CLASS 12TH)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<b>B</b>	<b>D</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>A</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>D</b>	<b>B</b>	<b>B</b>	<b>D</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>A</b>
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
<b>C</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>A</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>B</b>
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
<b>A</b>	<b>A</b>	<b>D</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>B</b>
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
<b>B</b>	<b>D</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>A</b>	<b>D</b>	<b>B</b>	<b>B</b>	<b>D</b>	<b>A</b>	<b>B</b>
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>C</b>	<b>C</b>	<b>A</b>	<b>A</b>	<b>B</b>	<b>D</b>	<b>B</b>	<b>D</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>D</b>	<b>D</b>